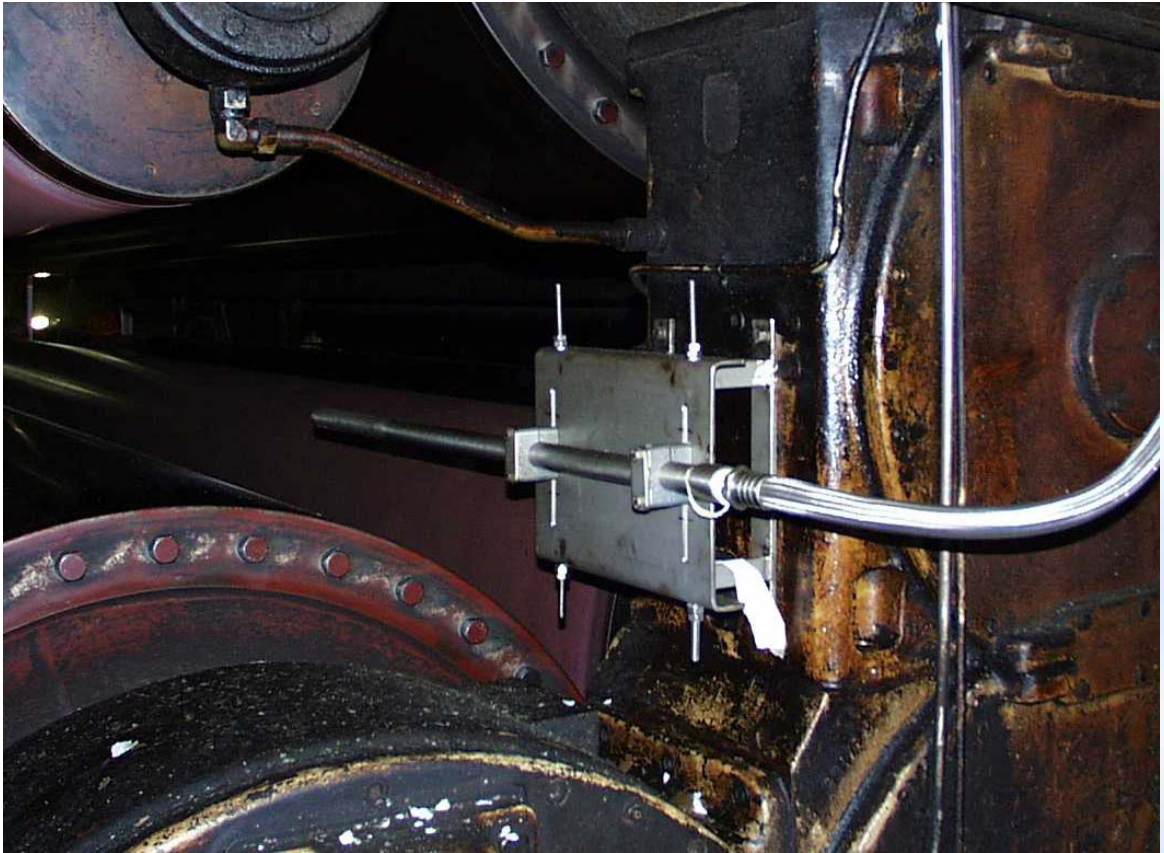




KAJAANI
PROCESS MEASUREMENTS



INSTRUCTION MANUAL

WebEye WE/3-6-9 & WebEye WE/3-6-9 LT

Fiber-Optic Web Break Detector

Table of contents

1. Description.....	3
2. Self cleaning sensor head.....	4
3. Operating principle.....	5
4. Technical data.....	5
5. Installation instructions.....	6
5.1. Delivery limits.....	6
5.2. Sensor installation.....	7
5.3. Installation of the rigid conduit and the display unit (WE/3-6-9).....	8
5.4. Installation of the rigid conduit (WE/3-6-9 LT).....	8
5.5. Installation of the fiber-optical cable for WE/3-6-9 LT.....	9
6. Wiring.....	11
6.1. WE/3-6-9 Wiring.....	11
6.2. WE/3-6-9 LT Wiring.....	12
7. Display unit operation and configuration.....	13
7.1. Main menu.....	13
7.2. Display unit configuration	13
7.3. Sensor position tuning.....	15
7.4. Alarm trigger level setting.....	15
7.5. Analog output scaling / setting offset value	15
7.6. Case 1.....	16
7.7. Case 2.....	16
7.8. Case 3.....	17
8. To set password and protect settings.....	18
9. Operating and setting instructions for the IR amplifier.....	18
10. WebEye trouble shooting guide.....	19
11. Sensor head service.....	20
12. Spare parts.....	21

1. Description

The WebEye fiber-optic web break detection system operates on a proven non-contact, reflection principle. An optical sensor is placed above or under the web to be monitored. Typical applications include paper and board webs, and felts. The IR amplifier sends a special light signal to the surface to be monitored. The reflected light is picked up by fiber optic cable and transmitted to the IR amplifier. This signal is then converted to 4 - 20 mA signal or on/off information. The sensor is not affected by dirt, dust, steam or high temperature, because of self cleaning sensor head construction.

WebEye is Kajaani Process Measurements solution to high temperature sheet break applications. The optical sensor is connected through a fiber optic cable to an IR amplifier. While the sensor head is exposed to high temperatures, the IR amplifier is mounted 3 m (10'), 6 m (20') or 9 m (30') away in a less hostile environment. For added flexibility, the digital display unit of WE/3-6-9 series can be installed up to 300 m (1000') away from the IR amplifier housing.

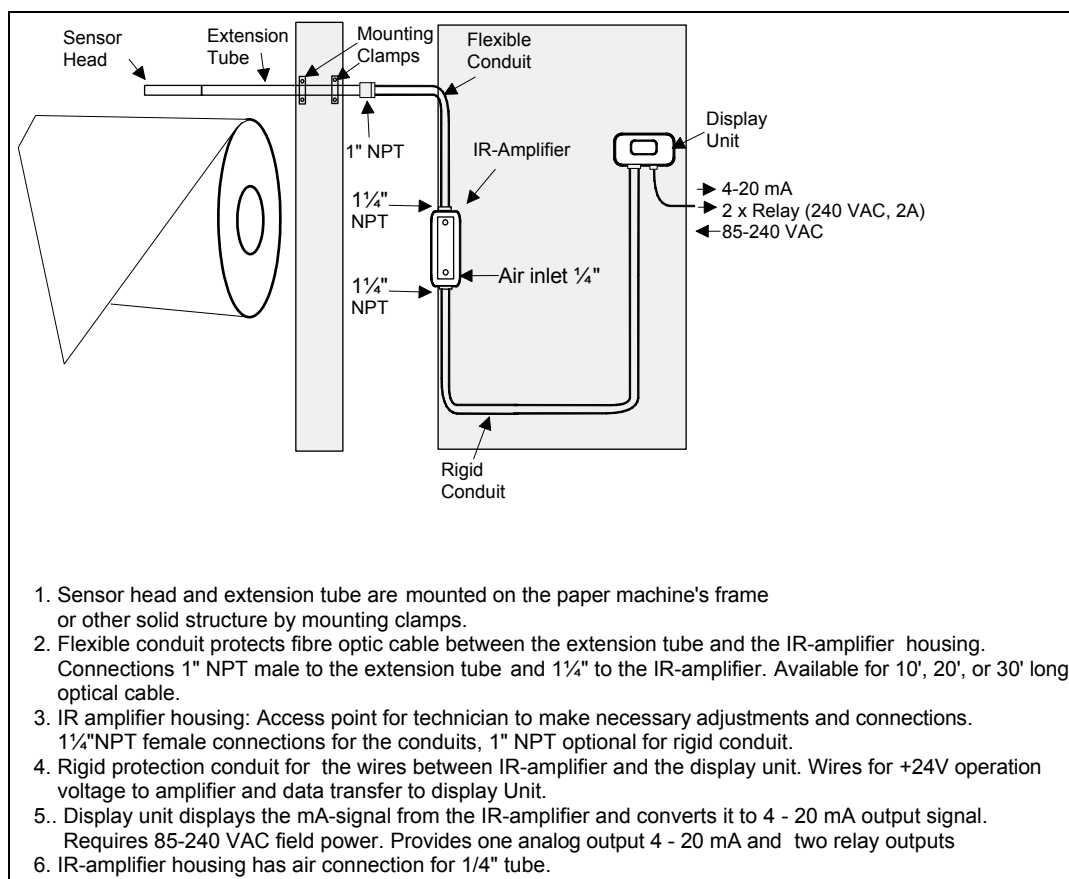


Figure 1. WE/3-6-9 system components.

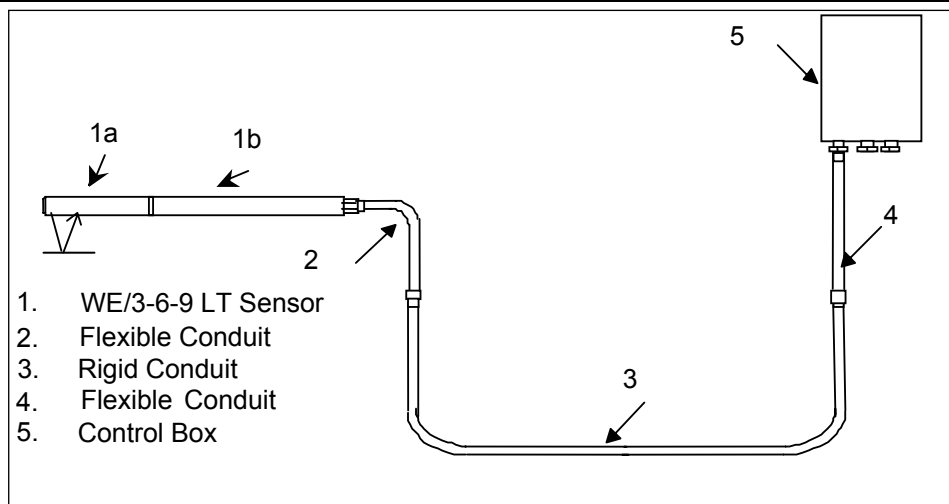


Figure 2. WE/3-6-9 LT components and typical installation.

2. Self cleaning sensor head

Sensor head is kept clean by purging instrument air through the sensor housing. Flowing air keeps the optic lenses clean and avoid dirt or steam to contaminate on the active optic surfaces. Purging air helps also keeping sensor head temperature lower in high temperature applications.

The WebEye requires positive, clean instrument air at 0.46 - 0.67 bar (7 - 10 psi), to cool down sensor head and keep the lenses clean. Air inlet is located in the IR amplifier housing in case of WE/3-6-9 series and in the control box of WE/3-6-9 LT. The rotameter can be used for easy detection of airflow.

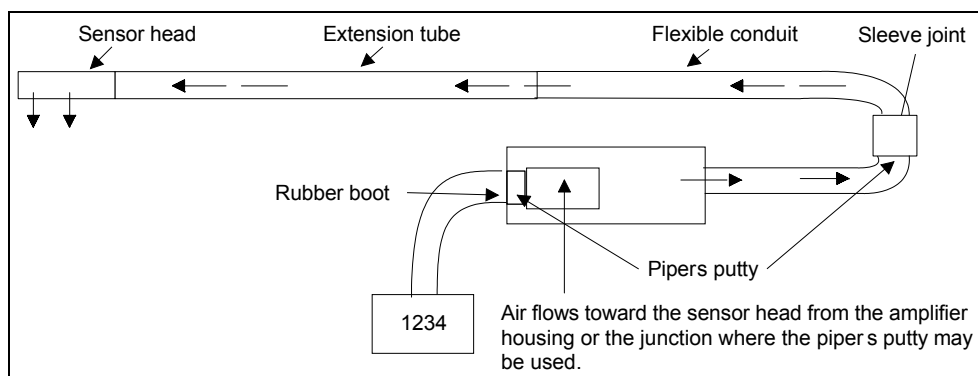


Figure 3. Example of WE/3-6-9 purge air arrangement.

3. Operating principle

The WebEye operates on a proven, non-contact reflection principle. An optical sensor is placed above or under the web to be monitored (applications include paper or board webs, wires or felts). The sensor is not affected by dirt, steam or temperatures up to 177 °C (350 °F) when installed according to Kajaani Process Measurements specifications.

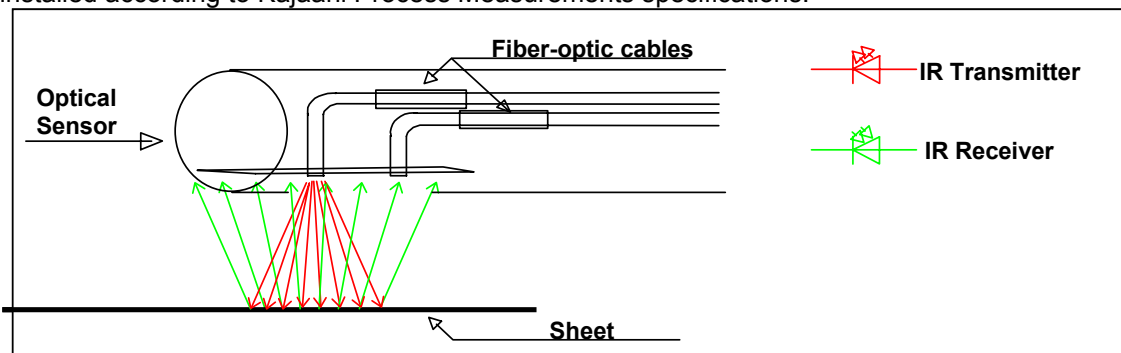


Figure 4. Operating principle.

The optical sensor is connected through a fiber-optic cable to an IR amplifier located at the end of the sensor tube. The IR amplifier sends the light from the transmitter element through the fiber optic cable onto the monitored surface. The reflected light is picked up and transmitted through the fiber optic cable to the IR receiver of the amplifier. This returning signal is converted to an on/off voltage as relay output or a 4 - 20 mA current signal.

The self-cleaning sensor head is a 25.4 x 305 mm (1 x 12") stainless steel tube with two holes at the head serving as eyelets for the fiber optics and outlets for purge air. Continuous airflow through the stainless steel enclosure keeps positive pressure around the sensor head's eyes and keeps the eyelets free of dust or debris. The openings should be located perpendicular to the surface being monitored.

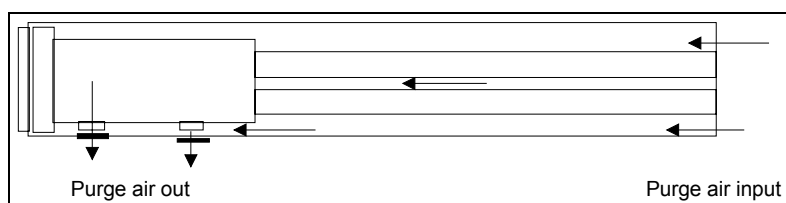


Figure 5. Purge air operation.

4. Technical data

Sensor

Ambient temperature	-10 ... +177 °C (15° - 350 °F)
Sensor head	Ø 25.4 mm (1") SS tubing, 305 mm (12") long
Extension tube	Ø 25.4 mm (1") SS tubing, 1500 mm (59") long
Fiber optic cable options	3 m (10'), 6 m (20') or 9 m (30')
Weight approximately	0.9 kg (2 lbs)
Installation	Distance of from the web 5 - 30 cm (2 - 10")

IR amplifier (WE/3-6-9 series)

Frequency	4 kHz
Power consumption	70 mA (24VDC powered from Display Unit)
Ambient temperature	-10 ... +70 °C (15° - 160 °F)
Enclosure classification	IP 66 (Nema 4X)
Dimensions	305 x 50.8 x 76.2 mm (12 x 2 x 3")

Connection	31.75 mm (1 ¼") NPT
Display unit (WE/3-6-9 series)	
Power supply	85-240 VAC/50-60 Hz
Output	4 - 20 mA isolated, 2 on/off dry contact relays (230V, 2A max)
Max. distance from IR amplifier	300 m (1000')
Weight	3.6 kg (8 lbs)
Dimensions (L x H x D)	152 x 115 x 145 mm (6 x 4.5 x 5.7")

Control box (WE/3-6-9 LT series)	
Power supply	85-240 VAC/50-60 Hz or 12-32 VDC (option)
Output	4 - 20 mA isolated, 2 on/off dry contact relays (230V, 2A max)
Weight	4.4 kg (10 lbs)
Dimensions (L x H x D)	220 x 245 x 145 mm (6 x 4.5 x 5.7")

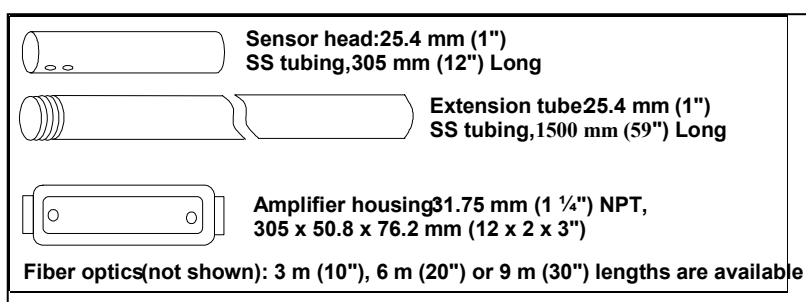


Figure 6. Dimensions.

5. Installation instructions

Note: Do not mount several fiber optic sensing heads side by side; a mutual interference may occur.

5.1. Delivery limits

WE/3-6-9

Manufacturer supplied components:

- WebEye sensor head, 1 ea
- Extension Tube with position memory, 1 ea
- Mounting clamps, 2 ea
- IR amplifier housing, IR amplifier enclosed, 1 ea
- Display Unit, 1 ea
- Flexible conduit for fiber optical cable protection (SS tubing, 1" diameter)
- Option: Mounting rack
-

WE/3-6-9 LT

Manufacturer supplied components:

- WebEye sensor head, 1 ea
- Extension Tube with position memory, 1 ea
- Mounting clamps, 2 ea
- Flexible conduit (26", 1" diameter), 2 ea (fig 12)
- Control Box, 1 ea
- Option: Full length flexible conduit (fig. 13)
- Option: Mounting rack

5.2. Sensor installation

The sensor should be installed about 25 cm (10") in from the edge of web and 15 cm (6") above it (standard range is 10 - 20 cm (4 - 8") side of the machine).

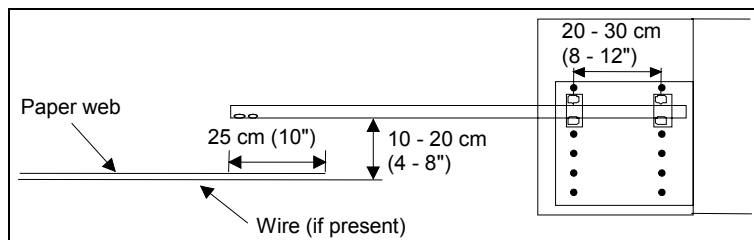


Figure 7. Typical installation.

The following steps describe a typical installation.

Install the mounting clamps or the rack (optional) on paper machine's frame or other solid mounting structure. Leave 20 - 30 cm (8 - 12") between the clamps. Mounting technique is optional. The suggested method for mounting is to fix the clamp to paper machine or a solid steel plate and attach it to paper machine. It is recommended to leave option to adjust clamp height so that sensor head can be positioned optimally during start-up.

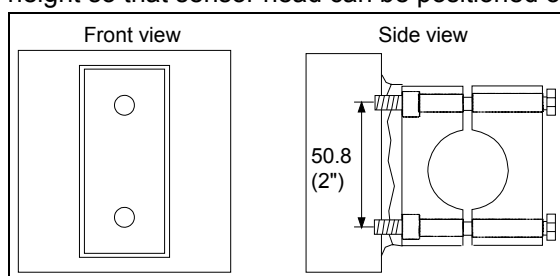


Figure 8a. Mounting clamp.



Figure 8b. Mounting rack (option)

Feed the free end of the fiber optic cable through the extension tube, screw the extension tube and sensor head together, and slide the sensor and extension tube assembly through the mounting clamps. Rotate the eyes into a position perpendicular to the web and semi-tighten the clamps. The sensor should be rotated until the signal received by the IR amplifier is at it's strongest possible (this is usually the perpendicular position).

Insert the pin in the position memory ring (Figure 9) into the hole in the clamp and tighten the stop screw. If the sensor is removed for maintenance the memory ring ensures that the sensor head is positioned exactly in the same position when re-installed.

Feed the free end of the fiber optic cable through the flexible conduit while the conduit is still loose. Secure the conduit so it does not move along its route to the IR amplifier housing, leaving 15 cm (6") exposed.



Figure 9. Position memory

Note: Use caution when pulling fiber optic cable through the conduit. Fiber optic cable is a fragile material.

5.3. Installation of the rigid conduit and the display unit (WE/3-6-9)

Run 1" or 1¼" rigid conduit from display location to IR amplifier housing location, pulling the four-conductor cable or wire through the conduit. Leave about 1.2 m (4') of free cable at the IR amplifier end. Position the IR amplifier housing beyond hot temperature (less than 70 °C (160° F)).

Feed the wire/cable into IR amplifier housing and screw housing onto the 1¼" rigid conduit.

Feed the exposed fiber optic cable into the IR amplifier unit, and attach it to IR amplifier.

Attach the flexible (seal tight) conduit to IR amplifier housing.

Mount the display unit and wire the display according to the wiring diagram.

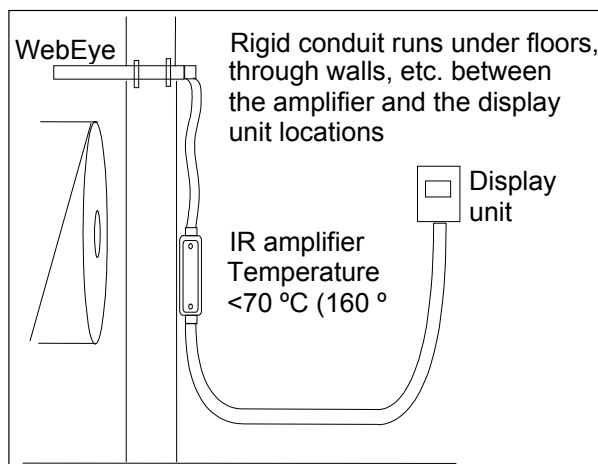


Figure 10. Typical WE/3-6-9 installation.

5.4. Installation of the rigid conduit (WE/3-6-9 LT)

Install the optical sensor head (1) and the extension (2) as per section 5.2..

Attach one of the two flexible conduits (3) between the end of the extension tube (2) and the beginning of the rigid conduit (4); the second flexible conduit is attached at the end of the rigid conduit and at the opening to the control box (5).

Rigid conduit (4) - recommended diameter 1 inch, minimum i.d. 0.85 inches- is installed to protect the fiber-optic cable for the remaining length of cable run. Bends in the rigid conduit should have a **radius no smaller than 5 inches**. All rigid conduit connections should be sealed to maintain a positive internal pressure.

WE/9 LT rigid conduit length is 5705 mm, WE/6 LT rigid conduit length is 2705 mm

WE/9-6-3 LT is also available with full flexible conduit (figure 12).

Note: Do not force the cable through the conduit.

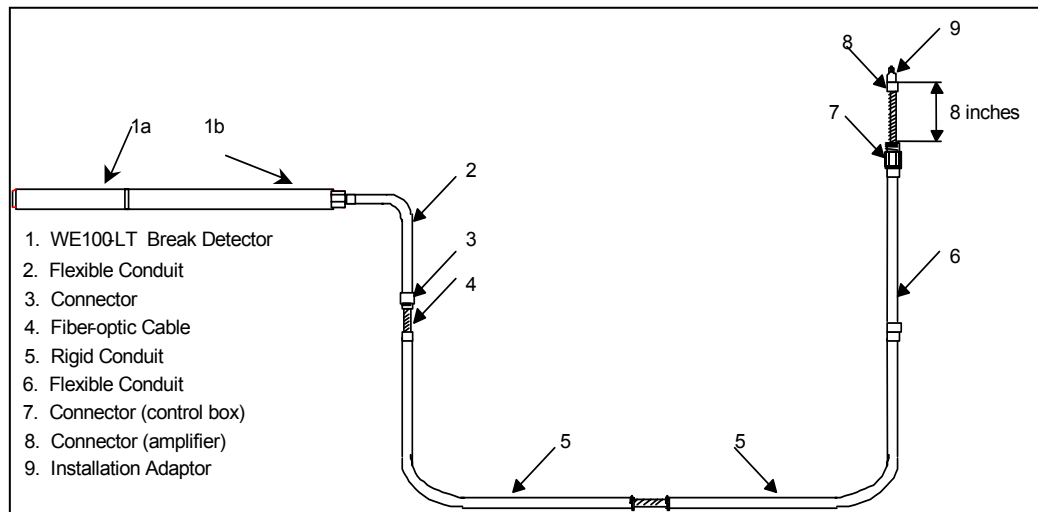


Figure 13. Installation of WE/3-6-9 LT fiber-optical cable.

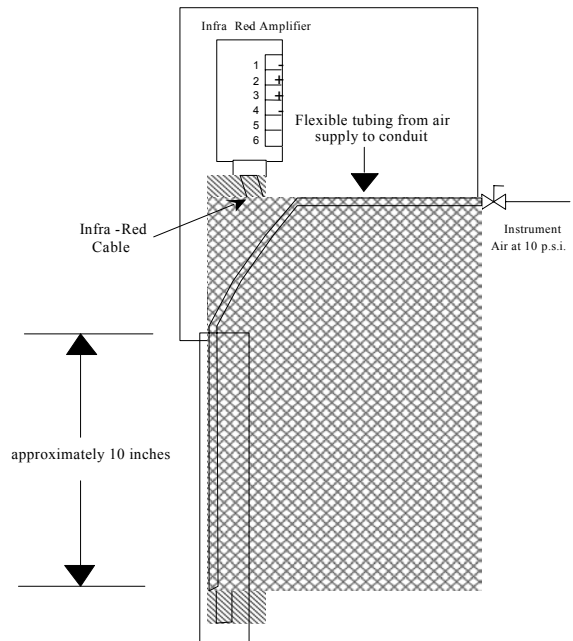
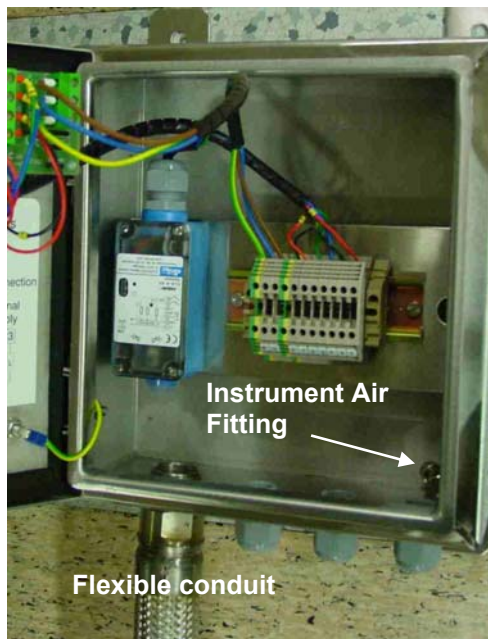


Figure 14. Instrument air purge arrangement.

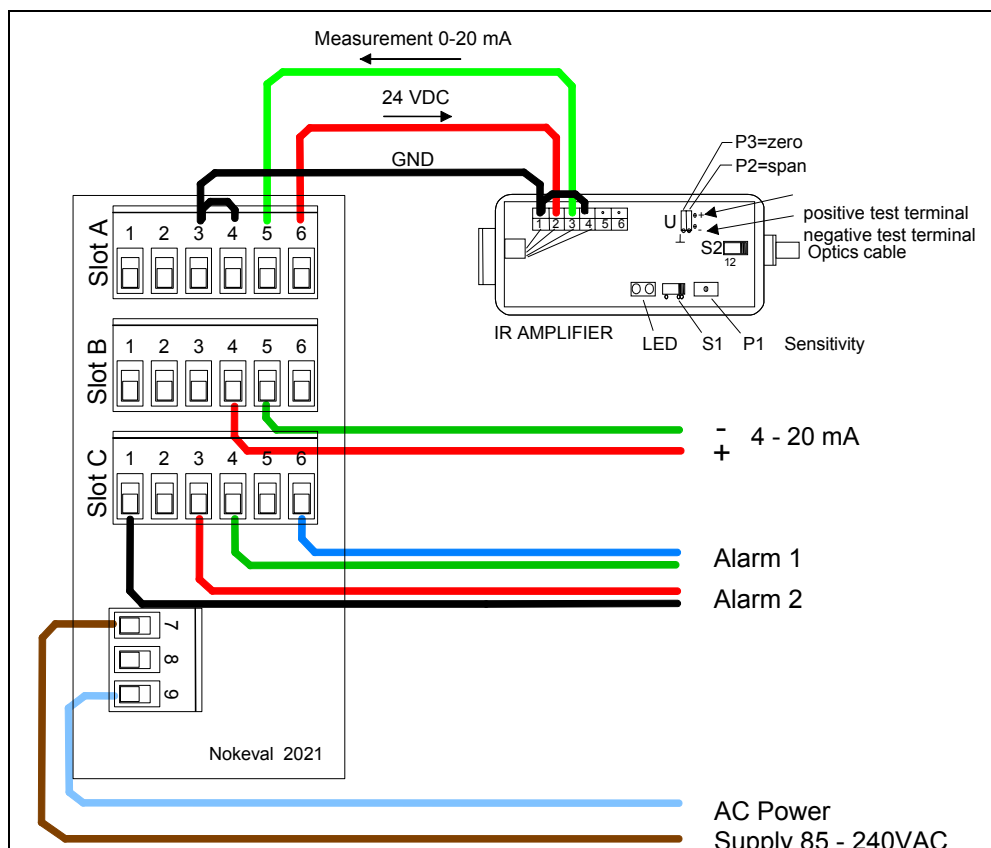
Supply dry and clean filtered instrument air, at 10 psi, to the cabinet. A small flexible hose/tube should be connected to the air fitting on the bottom of the cabinet and pushed into the conduit (6) approximately 10 inches. This ensures that the majority of the purge air is pushed down into the conduit and that a small amount bleeds back into the actual cabinet enclosure. Seal all connections and cover all other cabinet openings.

6. Wiring

6.1. WE/3-6-9 wiring

Wire the IR amplifier housing according to the wiring diagram 15.

Note: Improper wiring will fatally damage the display and IR amplifier. Make all connections before applying power.



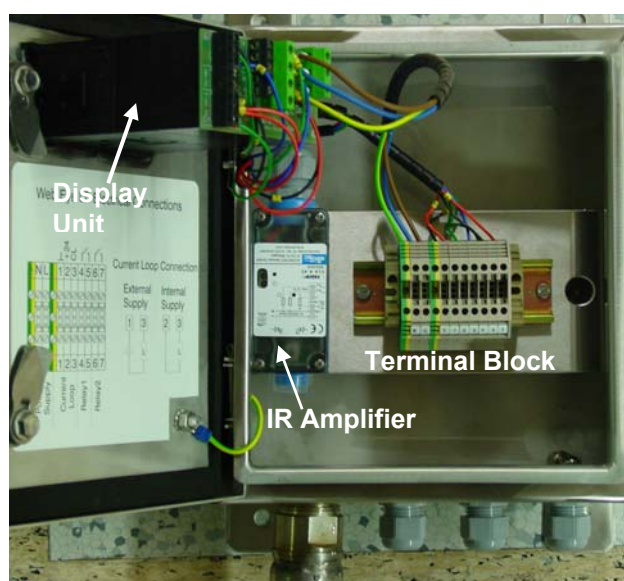
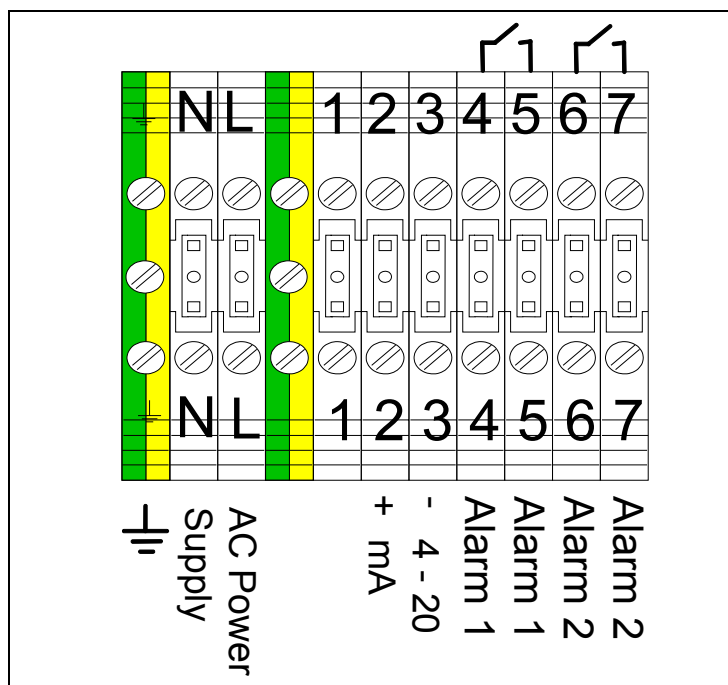
WE wiring (Nokeval 2021 Display)

Display		Signal	IR Amplifier pin
Slot	Pin		
A	3,4	GND	1,4
A	6	+24VDC	2
A	5	Measurement 0-20mA	3
Output signals			
B	4	+ 4-20 mA	
B	5	- 4-20 mA	
C	1	Alarm 2	
C	3	Alarm 2	
C	4	Alarm 1	
C	6	Alarm 1	
Power supply			
Power	9	85-240VAC	
Power	7	85-240VAC	

Figure 15. WE/3-6-9 wiring diagram.

6.2. WE/3-6-9 LT wiring

Connect the external cables according to the wiring diagram 16. Internal wiring has been made according to figure 15.



Fiber-optical Cable 85 - 240 mA Alarm VAC Output 1 & 2

Figure 16. WE/3-6-9 LT wiring diagram.

7. Display unit operation and configuration

7.1. Main menu

During the normal run the display shows:

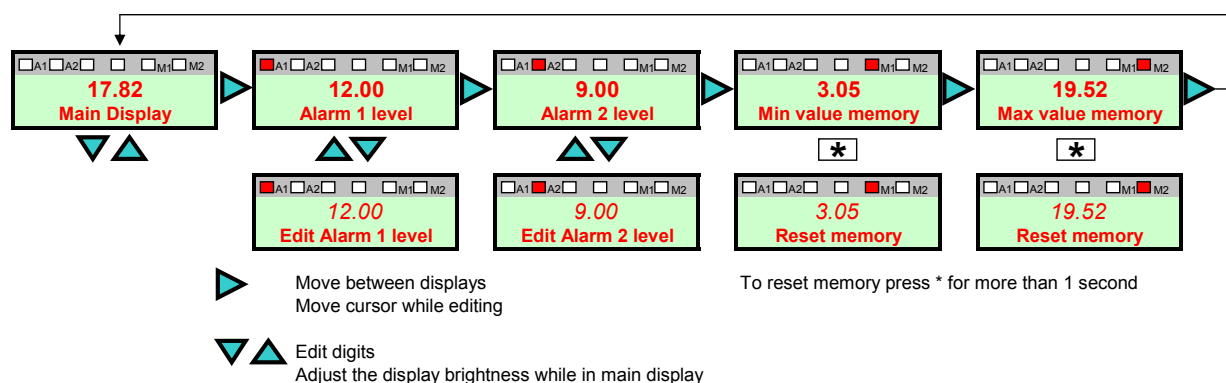
- measured reflectance value from the web (normally 0 - 22)
- status of alarm outputs A1 and A2 (light lit when alarm on)

By pressing ► key one can display trigger levels of alarm 1 and 2, and read minimum or maximum measurement values since the last reset.

Alarm trigger level is adjusted with ▲ ▼ keys when in alarm level display. Asterisk (*) is used to return back to previous menu or to reset.

Min/Max memory is convenient to check the process noise for setting the alarm limits.

The operation flowchart for main menu is:



Flowchart 1. Main menu, monitoring the minimum and maximum measurement values, and setting the alarm limits.

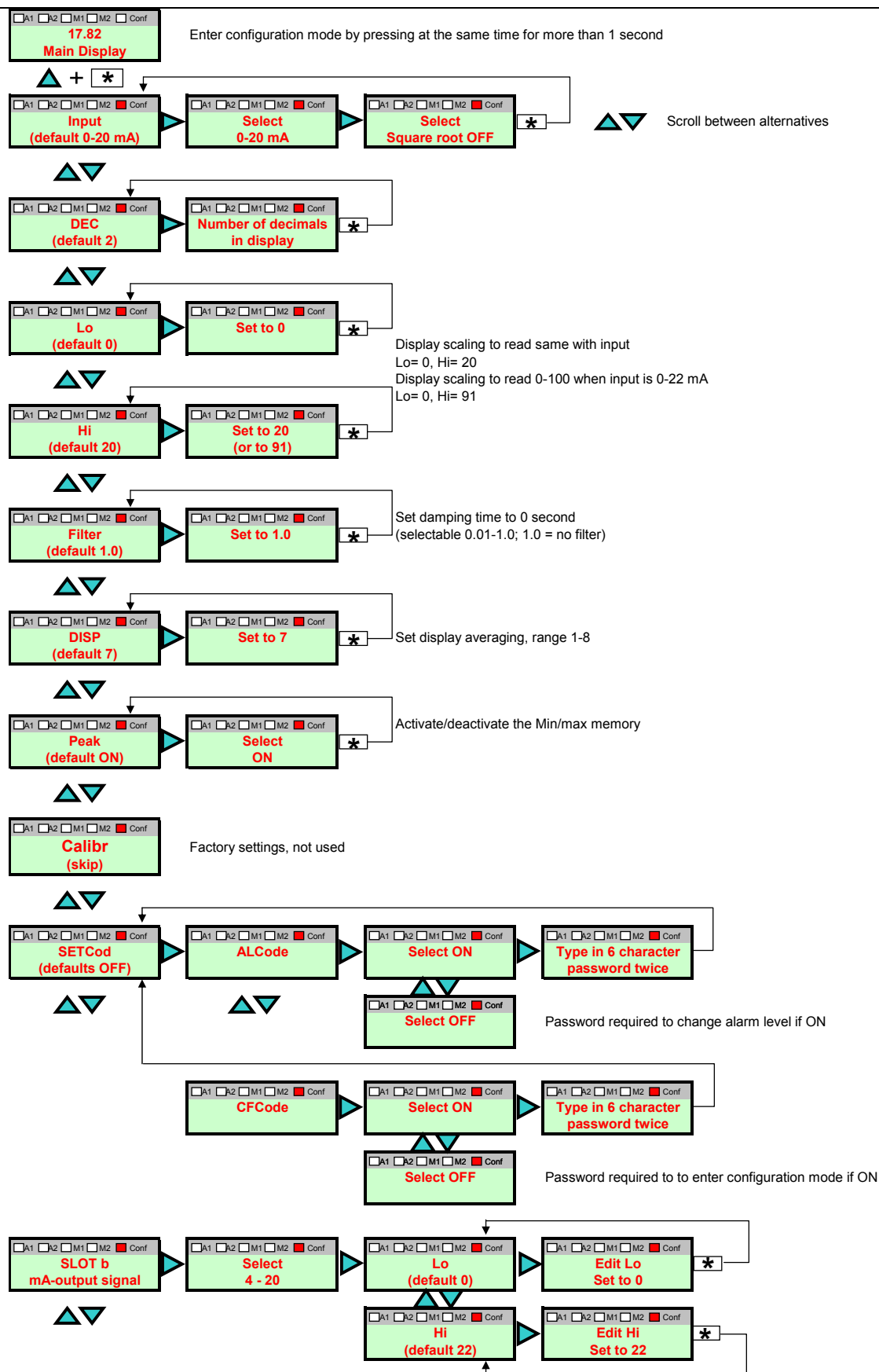
7.2. Display unit configuration

For entering into the programming mode press ▲ and * keys simultaneously for 2 seconds.

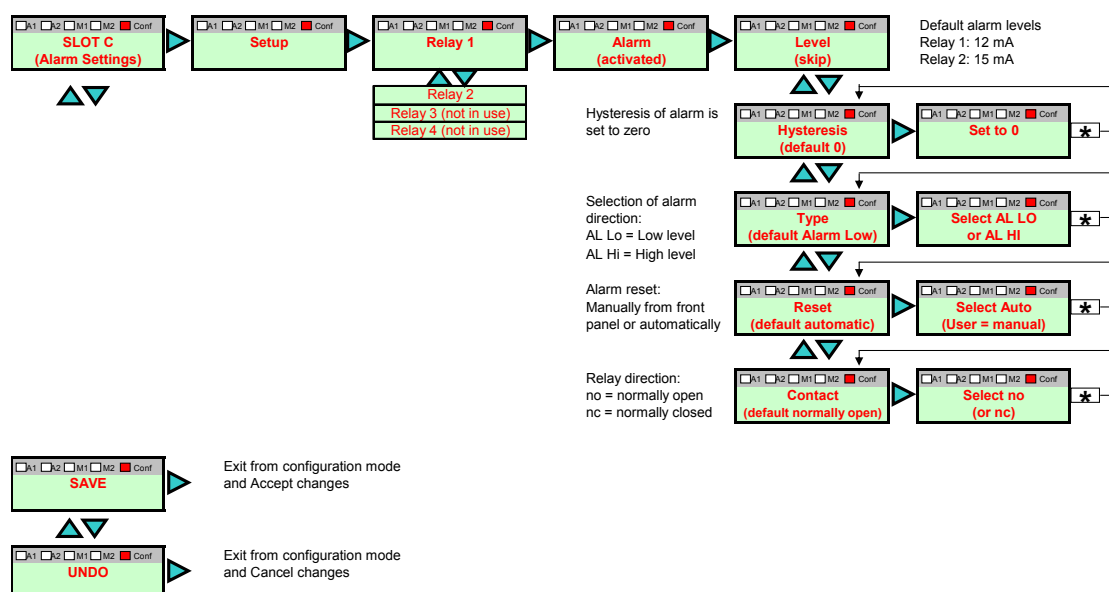
To exit from configuration mode you have to **accept** changes (display “SAVE” , press ►) or to **cancel** changes (display “UNDO”, press ►).

The default values are as follows:

1. Input signal 0-20 mA, linear. Signal level from the IR-amplifier ranges from 0 to 22 mA.
2. Number of decimal points in display (DEC) 2.
3. Display scaled same as input signal (0-20). Lo = 0 ; Hi = 20
4. Filter (damping of input signal) 1.0 (no damping). If filtered would cause delay of alarm.
5. Display reading (DISP) damping average of 7 measurements. Averaging of display does not affect alarm relay speed.
6. Min/max memory (Peak) ON (activated)
7. Passwords (SETCode) not in use.
8. Alarm settings (Slot C) for both relay 1 and 2: alarm activated, hysteresis 0, triggered when signal below limit, automatic reset of alarm when signal returns above trigger level, alarm contact normally open.



Flowchart 2a. Setting the basic parameters of display unit.



Flowchart 2b. Setting the basic parameters of display unit.

7.3. Sensor position tuning

Adjust the sensor head position to get low IR amplifier reading when web is off (open draw break, no web-on-cylinder conditions). Try to get value as low as possible, e.g. 0 to 5 mA.

Tune high reading when web is on by adjusting sensor position – height and angle of beam. Try to get value as high as possible, e.g. 15 - 20 mA. If value is too high or too small tune sensitivity pot in IR-amplifier (see figure 15).

Write down the low and high readings.

7.4. Alarm trigger level setting

Set break alarm A1 trigger level to the midpoint between the signal levels obtained in 7.3.

A2 can be used for service alarm (see case 1).

Press ►, display shows the break alarm A1 trigger level (for example 12).

Press ▲ or ▼ to adjust the number.

Press * key to accept and to move to alarm A2.

Adjust service alarm A2 trigger level by ▲ or ▼ button. (for example 14).

Press * key to accept.

Move with ► key to main display

7.5. Analog output scaling/setting offset value

Analog output is scaled to have 4 mA when signal from IR amplifier is 0 and 20 mA when IR-amplifier signal is 22 mA. If mA from the IR amplifier were 0 or close to 0 mA the DCS would read 0%. Signal would be drawn on x-axis and trend not really seen from the DCS window.

To elevate the signal, adjust Lo mA output to -1. This gives 4,7 mA or 4% output during a break (0 - 22 mA from IR-amplifier equals to 4,7 - 20 mA or 4% - 100 % in DCS display). Refer to flowchart 2a, SLOT b menu.

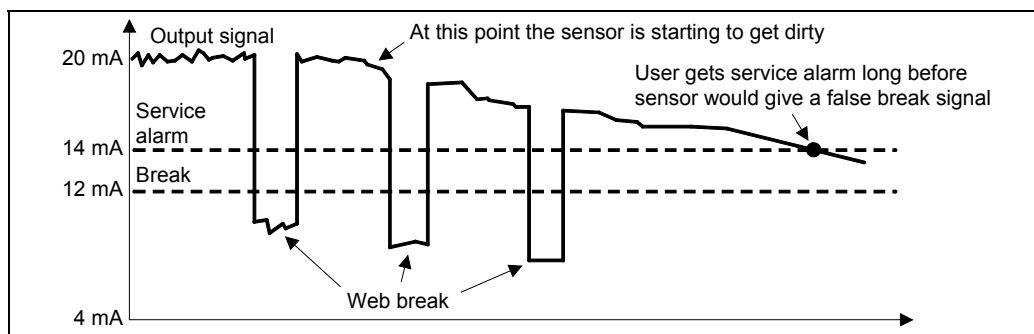


Figure 17. Output signal.

7.6. Case 1

The sensor monitoring breaks with open space behind the sheet. For optimum performance “sheet-on” calibration should be done when the paper machine is running at production speed. Sensor head adjusted so that the IR amplifier signal is about 20 mA with paper on and about 0 mA without paper.

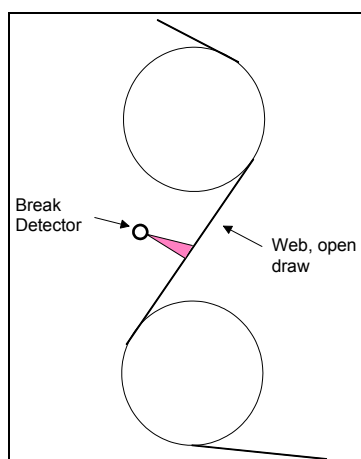


Figure 18. Free space behind the paper web.

WebEye output is scaled to 4 - 20 mA to correspond to 0-22 mA signal from IR-amplifier. 0.0 mA from IR amplifier means 4 mA output to DCS. In the trend display of a DCS this equals to 0%. For better visualization 4-20 mA output can be scaled to correspond to -1...22 mA mA input. During break DCS would read 4% and with web on 87%.

Alarm limits can be set as follows:

A1= alarms when break =trigger point e.g. 10 mA and activated when below trigger point.

A2= alarms for service if signal from sensor drifts below e.g. 14.00 mA with paper on. This could happen, for example, when piece of paper gets stuck with sensor head or sensor eye holes get dirty.

7.7. Case 2

The sensor monitoring breaks with wire or felt behind the sheet. Sensor head is adjusted so that the IR amplifier signal is e.g. 15.0 mA with web on and 7.0 mA against wire or felt. Respective output current levels to DCS are 15 mA and 9 mA.

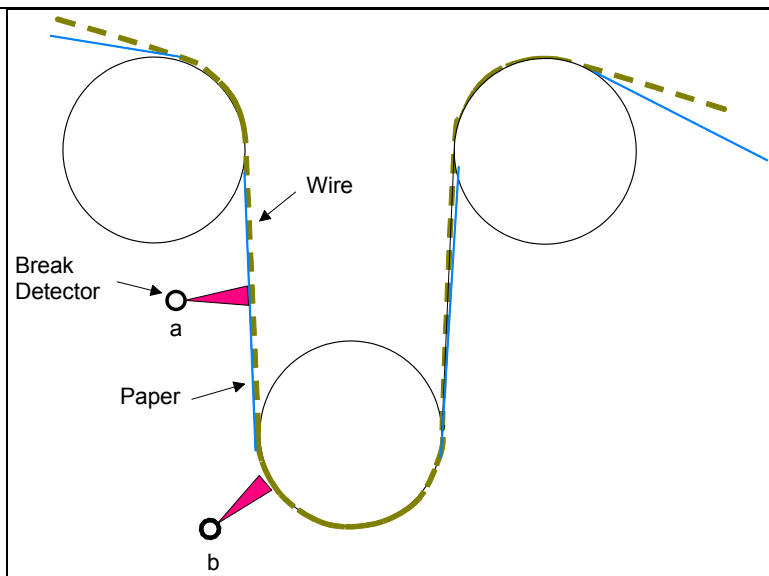


Figure 19. Felt/wire under the sheet

Alarm limits can be set as follows:

A1 alarms for break. Trigger level e.g. 11 mA and activated when below trigger point.

A2 alarms for service if signal from sensor drifts below e.g. 12 mA with paper on.

7.8. Case 3

The sensor monitors surface of a cylinder. In case of a break the paper may get wrapped around the cylinder. Sensor head is adjusted so that the IR beam reflects from cylinder surface in mirror like manner. No backscattering will happen and signal IR amplifier is zero. If paper gets wrapped around the cylinder it will cause backscattering of light and amplifier signal is e.g. 12.0 mA.

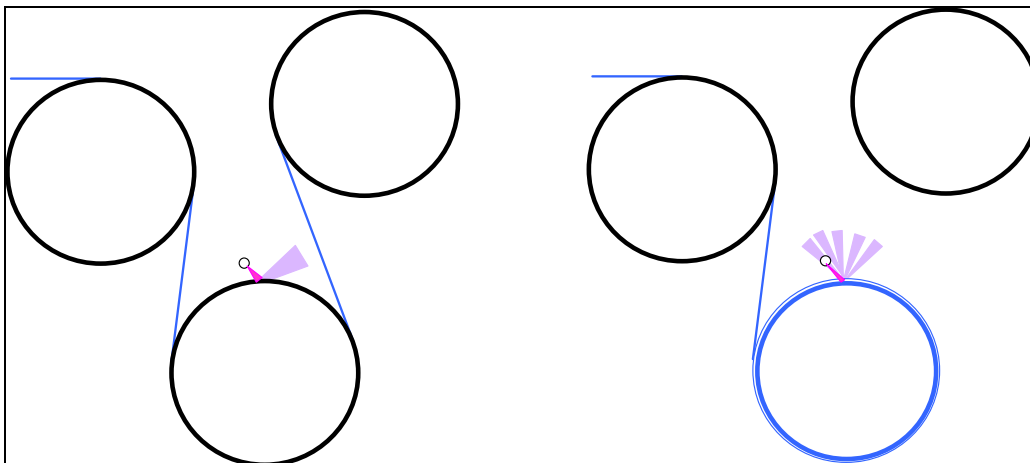


Figure 20. Detecting paper wrapping around a cylinder

Like in case 1 WebEye mA output to DCS can be elevated by scaling output to -1...22 mA. Output current to DCS would range from 4% to 52%.

Alarm limits can be set as follows:

A1 and A2 alarm directions set to alarm when signal exceeds trigger levels (see flowchart 2b).

A1 alarms for wrapping. Trigger level e.g. 10 mA and activated when exceeds trigger level.

A2 alarms for service. Triggered if signal from sensor without wrap drifts above e.g. 5.0 mA.

8. To set password and protect settings

Configuration and change of alarm levels can be protected by separate 6-character passwords. Configuration protection is activated in CFCode menu (see flowchart 2a). The code is entered by pressing front panel keys ▲, ▼, *, ► in wished order. You can imagine that ▲=1, ▼=2, *=3, and ►=4 to memorize the code. The code must be repeated before it is accepted. Alarm level password is set in ALCode menu.

Example to set configuration protection : Press ▲ and * for 2 seconds – SetCod- ALCode- CFCode-On- ▲▲*►▲▲-▲▲*►▲▲-save-►. The code would be then 113411.

9. Operating and setting instructions for the IR amplifier

If doing set up in instrument shop, observe installed distance on machine and duplicate during set up. Use same paper as on machine. Please notice that temperature might be totally different as on machine.

Factory settings are suitable for most applications. When the unit is received by the customer the IR amplifier is adjusted as described below. Normally these adjustments need not to be changed.

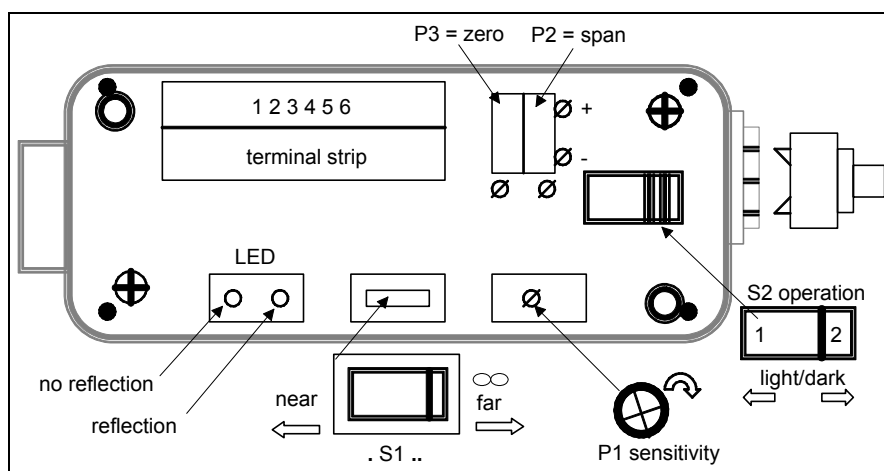


Figure 21. IR amplifier.

Connections and settings

1. Remove the cover.
2. Connect the IR amplifier according to connection figure 10.
3. Place switch S1 to the position ∞ (FAR) and S2 to position 2 (DARK).
4. Max out span pot P2 by turning clockwise until clicks are heard.
5. Set the sensitivity to max by turning P1 clockwise until clicks are heard.
6. Mount light cable and place sensing head into correct position for viewing the web.
7. Turn on the power supply; green or red LED must be lit.
8. Warm-up time of IR amplifier is approximately 10 minutes before optimal performance is obtained.

9. With open space (no sheet) under sensor, adjust zero pot P3 to 0 mA. Measure on display unit terminal 5, about 0 - 1 mA.
10. Put sheet under sensor and observe mA input on terminal 5 of display unit (output should be 10 - 15 mA). If not adjust sensor distance from the sheet or tune sensitivity pot of IR-amplifier.
11. Remove the test sheet. Repeat step 9.
12. Repeat steps 9 and 10 until the sheet and no sheet signal settings are both correct.
13. Reinstall IR amplifier cover; leave all switches in above positions.

Note: The light cables must be handled carefully: broken fibers, dirt or contamination deteriorate the switching behavior and diminish sensor performance.

Note: Use IR amplifier only with connected light cable.

Note: Keep distance from the web same during all set up procedures.

10. WebEye trouble shooting guide

Note: Make sure that the break detector is not on control before starting trouble shooting activities.

"Sheet on"-signal is too small, less than break level

- check sensor alignment - should face paper web
- check that the eyes are clean
- check if switch S1 is in the correct (∞ far) position
- check if switch S2 is in the correct (2 dark) position
- check if sensitivity pot (P1) is adjusted properly
- check if span pot (P2) is adjusted properly

Break detector misses a sheet break

- check that the sensor eyes are clean
- check the relay alarm levels A1 and A2
- check that the signal level was correct during break
- check that the PLC or DCS logic is correct
- check air pressure (adjust between 7-10 psi)

Devices connected to relays fail to work properly

- check test relay for proper operation
- check that the alarm relays are adjusted properly
- adjust the alarm trigger level

You cannot adjust the Zero or Span

- check that the power to IR amplifier is required 24 VDC

The display is blank

- check power connection to display unit
- the fuse on the display unit
- replace the display unit

11. Sensor head service

Fiber Optic lenses should be clean all the time. Cleaning should primarily to be done through the fiber optics opening in the sensor head. In case cleaning requires disassembly of the sensor head proceed as follows:

1. Remove the end plate by removing the two fastening screws.
2. Remove the locking ring
3. Pull the fiber-optic cable through the optical sensor housing.
4. Clean lenses and reinstall
5. Eyes should be centered over the holes in the pipe.

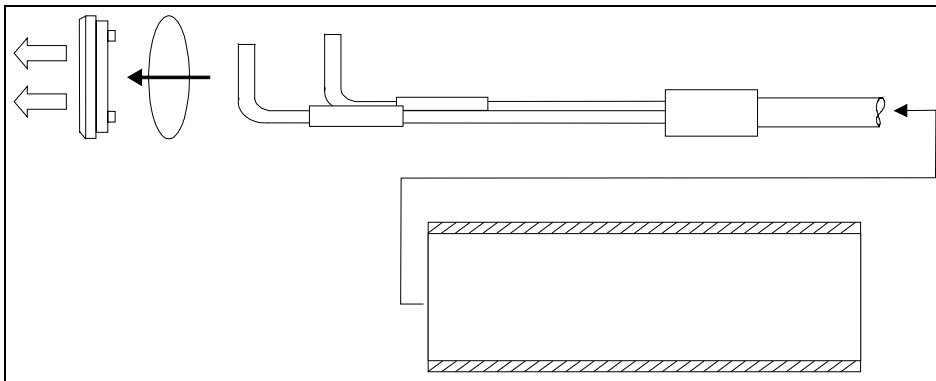


Figure 22. Dismantling the sensor housing.

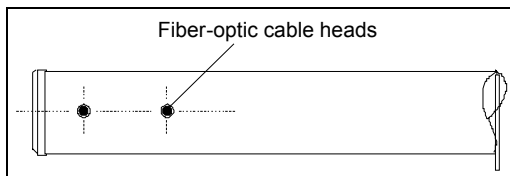


Figure 23. Fiber optic cable head.

12. Spare parts

1.	End cap	H41110043V1.0
2.	Screw (2 pcs)	2000051
3.	Lock ring	2000061
4.	Sensor head	H31110006V1.1
5.	Extension tube	H31110007V1.0
6.	Mounting clamp (2 pcs)	H41110024V1.1 and H41110033V1.0
7.	Fiber optic cable 3 m	99-0066
8.	Fiber optic cable 6 m	99-0068
9.	Fiber optic cable 9 m	99-0070
10.	Conduit body	H31110049V1.0
11.	IR amplifier	99-0026
12.	Display Nokeval 2021	3200001
13.	Hoffman box	H31110050V1.0

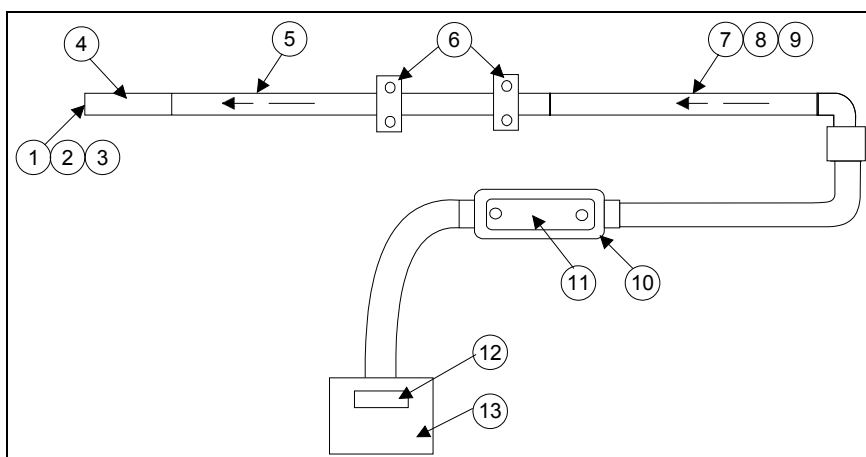


Figure 24. WebEye spare parts.